

UNITED STATES PATENT OFFICE

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UNDULATED TUBE AND METHOD OF MAKING THE SAME

Application filed January 17, 1931, Serial No. 509,457, and in Germany February 22, 1930.

The invention relates to a new form of tube blank and method for manufacturing undulated tubes for sectional boiler chambers, etc.

The object of the invention is to provide an undulating tube having angular cross section free from interior corner crevices, folds, lines of weakness, etc.

It is known to the art that inclined tube boilers have certain advantages, particularly those which are provided with sub-divided chambers known as chamber elements or sectional chambers. Such chambers are usually composed of straight tubes having approximately rectangular cross-section and whose inner as well as outer walls both form either right angles or a curvature at their junctions. Undulating sectional chambers composed of such type of tubes often show notchlike folds at the interior corners of the walls. These folds are often invisible in a finished chamber since they are generally covered with scale and, therefore, will not be discovered until the chambers are put into use when they may cause a fissure or breakage if the boiler is subjected to a high strain.

The object of the present invention is to provide a tube blank whose walls exteriorly form relatively sharp angles at their junctions, while interiorly said junctions are rounded to form re-inforcements following the undulations of the respective walls. When undulating such tube blanks, the dies used come in direct contact along the entire width of the walls to be undulated, while the other two walls are guided so that any bending or torsion at the wall junctions of the blank is wholly avoided. There is, therefore, no appreciable change in the formation of the interior rounded junctions, and the creation of folds or crevices is made impossible.

The accompanying drawing shows diagrammatically the forming of an undulating tube and which clearly illustrates the advantages of tube blank which is the subject-matter of the application in comparison with the tube blanks heretofore used.

Figure 1 is a view of a tube pressed into undulating shape.

Figure 2 shows a cross-section of the tube heretofore used within the pressing dies to

be pressed into the shape shown in Figure 1.

Figures 3 and 4 show fragmentary sections of the corner of the pressed tube of the type heretofore used as illustrated in Figure 2.

Figure 5 is a cross-section of a tube having a form embodying the invention, the tube being disposed in initial position for forming within a set of dies.

The method of manufacturing tubes for sectional chambers from blanks of the type heretofore used is as follows:

The dies after having been placed in position operate only upon the flat part of the tube walls, i. e., from *a* to *b* on Figure 2, while the rounded corners upon the tube are at first not gripped by the dies. Therefore, in this position a bending moment is produced along the line *l* during the pressing operation as shown on Figure 2. This moment produces a deformation of the cross-section of the tube during the pressing operation so that the rounded corners are converted on the outside to a sharp angle, while on the rounded off part on the inside a fold is produced, which forms a dangerous crevice or indentation. Figures 3 and 4 show such folds in cross-section taken through the corners of undulating chambers, that is to say, the chamber according to Figure 3 was produced by means of a sand filling and the chamber according to Figure 4 by means of a mandrel. It will be seen from the drawing apart from the folds and the sharp angles at *h* that the originally rounded outer edges of the cross-section now form a right angle with a sharp corner. The grain of the fibres which appear in the cross-sections in the etching show clearly the movement of the fibres in the tube during the pressing operation.

Figure 5 shows the cross-section of a tube having the form embodying the invention, the tube being disposed in initial position for the pressing operation. *O* is the upper die, *U* the lower die of the press and *F* the lateral supports.

The tube *T* which is to be undulated has a rectangular outer shape with sharp edges *E* and an inner cross-section of the form of a rectangle, the corners *J* of which are rounded.

Having thus fully described my invention, what I desire to secure by Letters Patent and claim as my invention, is—

1. As an article of manufacture, a tube free from internal corner crevices, folds and lines of weakness, including an upper and lower tube wall undulated in mutually corresponding manner, a pair of opposite sides connecting said upper and lower walls, which are generally plane and parallel with each other, said upper and lower and side walls exteriorly forming relatively sharp angles at their junctions and rounded re-inforcements disposed in the interior of said tube within said junctions of the walls thereof, said re-inforcements following the undulations of said upper and lower walls.

2. Method of making undulating tubes having a substantially rectangular cross-section while avoiding creation of interior corner crevices, which consists in forming a straight tube of substantially rectangular section with the exterior corners thereof meeting at relatively sharp angles while the interior corners are rounded, and corrugating the said straight tube by means of a die by applying the latter so that the pressure acts upon the whole breadth of the cross-section of the tube while avoiding the creation of folds by means of the presence of the rounded interior corners in said tube.

In testimony whereof I affix my signature.

MAX ULRICH.

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June 13, 1933.

M. ULRICH

1,913,417

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Filed Jan. 17, 1931

Fig. 1



Fig. 2

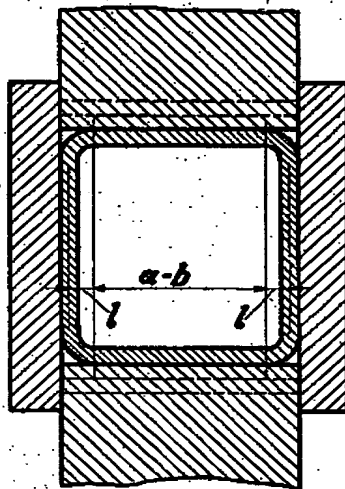


Fig. 3

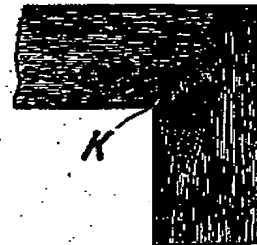


Fig. 5

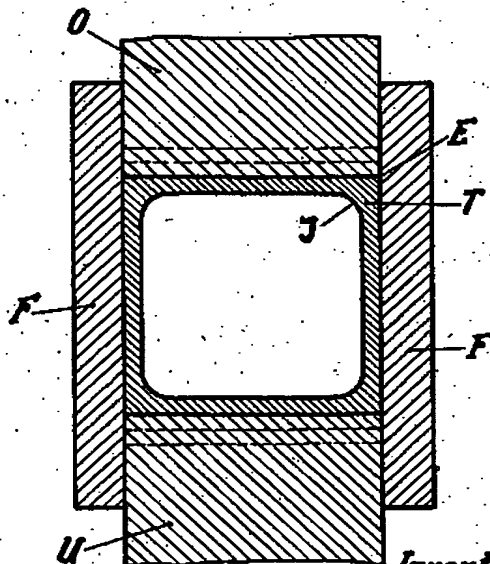
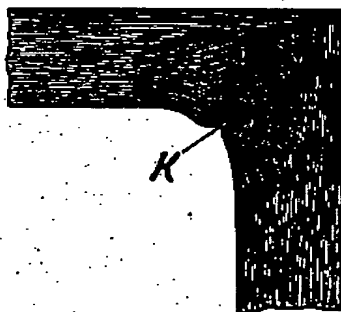


Fig. 4



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per *[Signature]*
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